NOMINATING PARTY: THE UNITED STATES OF AMERICA

FILE NAME: USA CUN13 SOIL **CUCURBITS** Open Field

BRIEF DESCRIPTIVE TITLE OF NOMINATION:
Methyl Bromide Critical Use Nomination for Preplant Soil Use for Cucurbits Grown in Open Fields (Submitted in 2011 for 2013 Use Season)

CROP NAME: Cucurbits Open Field

QUANTITY OF METHYL BROMIDE REQUESTED:

TABLE 1: QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION

Year	NOMINATION AMOUNT (KILOGRAMS)
2013	11,899 kg

NOMINATING PARTY CONTACT DETAILS:

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Following the requirements of Decision IX/6 paragraph (a)(1) The United States of America has determined that the specific use detailed in this Critical Use Nomination is critical because the lack of availability of methyl bromide for this use would result in a significant market disruption. ■ ***Yes*** ☐ *No*

Signature Name Date

Title:

(Details on this page are requested under Decision Ex. I/4(7), for posting on the Ozone Secretariat website under Decision Ex. I/4(8).)

This form is to be used by holders of single-year exemptions to reapply for a subsequent year's exemption (for example, a Party holding a single-year exemption for 2005 and/or 2006 seeking further exemptions for 2007). It does not replace the format for requesting a critical-use exemption for the first time.

In assessing nominations submitted in this format, TEAP and MBTOC will also refer to the original nomination on which the Party's first-year exemption was approved, as well as any supplementary information provided by the Party in relation to that original nomination. As this earlier information is retained by MBTOC, a Party need not re-submit that earlier information.

CONTACT OR EXPERT(S) FOR FURTHER TECHNICAL DETAILS:

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LIST OF DOCUMENTS SENT TO THE OZONE SECRETARIAT IN OFFICIAL NOMINATION PACKAGE:

1. PAPER DOCUMENTS: **Title of paper documents and appendices**	**No. of pages**	**Date sent to Ozone Secretariat**
USA CUN13 SOIL CUCURBITS Open Field	23	
2. ELECTRONIC COPIES OF ALL PAPER DOCUMENTS: ***Title of each electronic file (for naming convention see notes above)**	**No. of kilobytes**	**Date sent to Ozone Secretariat**
USA CUN13 SOIL <u>CUCURBITS</u> Open Field		

* Identical to paper documents

METHYL BROMIDE CRITICAL USE RENOMINATION FOR PREPLANT SOIL USE (OPEN FIELD OR PROTECTED ENVIRONMENT)

CUCURBITS

1. SUMMARY OF THE NEED FOR METHYL BROMIDE AS A CRITICAL USE:

This renomination covers cucurbits of several types (squash, melons, and/or cucumber) grown in the southeastern US (except Florida), Maryland, and Delaware. These crops generally are grown in open fields on plastic tarps, often followed by various other crops. Harvest is destined for the fresh market.

Only areas that cannot use alternative fumigants or non-fumigant options, and that face moderate to severe infestations of key pests, have been included in the calculation of nominated amounts and area to be treated. The applicants' requests have also been adjusted downward to account for the lower methyl bromide dose rates (see BUNNIE in Appendix A) for the southern regions of US cucurbit production, since increased use of high barrier films in conjunction with lower rates has been reported there. For the mid-Atlantic region, the low dose rates requested by the applicants were incorporated into calculations.

The USG has reviewed all factors affecting transition rates in this sector. Based on this assessment the transition rate has been greatly increased for most portions of this sector. For the area covered in this nomination, the USG believes that the narrative discussion included in this document is technically valid. The USG has nominated amounts of methyl bromide based only on those sub-sectors that cannot transition away from methyl bromide at the accelerated rate.

In developing this renomination the USG examined several recent studies to determine whether yield losses and market window losses associated with the best available fumigant alternative could be altered from previous nominations. Unfortunately none of the studies located by the USG met the criteria that earlier cited studies did. These criteria include: the use of fumigant alternatives registered for the crop nominated, the presence of both a methyl bromide standard and an untreated control as treatments as well as the monitoring of yields under each treatment. Several recent studies included a methyl bromide treatment or an untreated control but not both, or included both but did not monitor yield, or included unregistered alternatives. However, research conducted at the University of Georgia that examined use of a three way combination of alternative fumigants (1,3 D followed by chloropicrin followed by metam-sodium) did meet these criteria, Therefore, southern US areas were adjusted to reflect the technical feasibility of this three way combination of alternative fumigants under VIF or metallized films, as a replacement for spring-time applications of methyl bromide+chloropicrin, after accounting for areas in the south that face prohibition of 1,3 D due to karst topographical features.

The U.S. nomination is only for those areas where the alternatives are not suitable. For example, continuing research indicates that the three way combination mentioned above (the "UGA 3 way") does not adequately control key pests when used in place of methyl bromide in "fall" (i.e. August or September) fumigations. In U.S. cucurbit production there are several factors that make the potential alternatives to methyl bromide unsuitable. These include:

- The efficacy of alternatives may be significantly less effective than methyl bromide in some areas, making these alternatives technically and/or economically infeasible for use in cucurbit production.
- Some alternatives may be comparable to methyl bromide as long as key pests occur at low pressure. The U.S. is only nominating a critical use exemption (CUE) for cucurbits where the key pest pressure is moderate to high such as nutsedge in the Southeastern U.S.
- Regulatory constraints prevent use of some chemicals, e.g., 1,3-dichloropropene (1, 3-dichloropropene) use is limited in Georgia due to the presence of karst topographical features.

U.S. reliance on methyl bromide has dramatically and rapidly been reduced over the last eight years. Critical use exemption (CUE) requests have decreased every year since the U.S. phase-out process began. The development, registration, and use of new pest control products and production methods have been key to the progress and reductions made to-date. As alternatives have demonstrated their suitability, as thorough reviews of research results and applicant information have been conducted, and contacts have been made with regional crop experts to assess the technical and economic feasibility of alternatives, U.S. Government (USG) requests have reduced by 99%, for the fruiting vegetables, over the last 9 years. However, as the amount of methyl bromide available for use decreases each year, substantial challenges exist in the collection of needed data to substantiate on-going critical needs through the CUE process.

There are now several alternatives for soil fumigation, including 1,3-dichloropropene plus chloropicrin, the "UGA 3 Way" combination (1,3-dichloropropene plus chloropicrin followed by metam sodium), iodomethane plus chloropicrin, and dimethyl disulfide (DMDS) which have demonstrated some technical and economic feasibility for pest control in a number of vegetable crops in the U.S. Southeast. However, CUE applicants in this nominated sector have indicated that they are not always suitable for all situations. While DMDS has a Federal registration and has demonstrated effectiveness, it is not currently registered in all the relevant states. Given the timing of state registrations, lack of experience using this alternative, and application methods still under development to minimize odor in communities surrounding treated fields there is uncertainty in predicting when this alternative can be reasonably expected to adequately replace methyl bromide in specific application scenarios. While the DMDS registrant has been working with the product to reduce the odor, and growers are gaining experience in its use, work is still needed on application approaches for the alternative to be fully available for use in U.S. southeast vegetable crops. For example individual operators and small farms, which account for up to eighty percent of the growers in this nominated sector are especially hard-pressed to make this transition, because one of the most promising alternatives requires additional money to convert their fumigation equipment and custom fumigation applicators are not available in all areas. In addition to the expense to convert to the alternatives, there have been reports that the alternatives do not perform as well as the MeBr:pic combination.

These concerns about the alternatives have only recently been brought to the USG attention and insufficient supporting information was provided. Because of the uncertainties and challenges associated with the use of the available alternatives, the USG believes it most prudent and the best public policy to collect additional information so that the technical and economic impacts of these reported problems can be evaluated. The USG will request the applicants provide additional information to us no later than June 1, 2011 so that the information can be analyzed and provided to MBTOC by July 15, prior to the Open Ended Work Group (OEWG) meeting in early August. The quality of any additional information received will first be evaluated in terms of whether or not it supports a compelling case and confirms problems with the feasibility of alternatives. Then, on that basis, the USG will either support or withdraw this nominated sector at that meeting.

The nomination attached specifies the correct year (2013) and amount of methyl bromide that is being requested for the individual crops within this sector. However, there has been no attempt to update the information in this document regarding the new research, availability of alternatives, etc. Since the USG learned of the issues facing the growers within this sector, after speaking directly with researchers familiar with the specific problems only very recently, this information was not available at the time the USG recommendation was developed.

2. SUMMARIZE WHY KEY ALTERNATIVES ARE NOT FEASIBLE:

Our review of available research on other methyl bromide alternatives discussed by MBTOC for cucurbits suggests that, of registered (i.e., legally available) chemistries only metam sodium and 1,3 D + chloropicrin have shown potential as commercially viable replacement to methyl bromide. Non-chemical alternatives are either unviable for US cucurbits or require more research and commercial development before they can be technically and economically feasible. For some areas in the southeastern US, a 3 way combination of 1,3 D followed by chloropicrin alone, followed by metam-sodium, has shown promise against key cucurbit pests in spring season fumigation. The transition rate included in the BUNNIE incorporates an estimate of projected use of this strategy. In this nomination, the Southeastern U.S. includes the following states: Alabama, Arkansas, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

The recent Federal registration of iodomethane has not been used to adjust the amount of methyl bromide requested in this CUE, because this material has not been registered on cucurbits. Other reasons for considering an alternative technically infeasible for cucurbits include:

- There are significant restrictions on which crops can be rotated through after use of a given alternative (e.g., halosulfuron has rotational restrictions that prevent its use in southeastern US tomatoes).
- Resistance management prevents use of the alternative (e.g., glyphosate resistant weeds, such as Amaranth, in the southern US, prevent use of this alternative as a post-emergent weed control in those regions).

The following is the procedure followed for the 2009 allocation year:

For Southeastern U.S. and Georgia, metam-sodium and 1, 3 D + chloropicrin are the most promising alternatives for nutsedges and nematodes, respectively, which are the key target pests in these regions. However, where nutsedges are severe, metam-sodium, used alone, is technically and economically infeasible due to planting delays, yield losses and inconsistent efficacy, while 1,3 D + chloropicrin is infeasible in some areas due to (1) its use being prohibited on Karst topographic features, which are widespread in these regions, (2) a 21 day planting delay, and (3) yield losses.

There is also evidence that the pesticidal efficacy of both 1,3 D and metam-sodium declines in areas where it is repeatedly applied, due to enhanced degradation of methyl isothiocyanate by soil microbes (Ou et al., 1995; Verhagen et al., 1996; Dungan and Yates, 2003; Gamliel et al., 2003).

While one study in 2006 showed good efficacy of a combination of 1,3 D + chloropicrin and the herbicides napropamide + halosulfuron or metolachlor + trifloxysulfuron in small plots of Florida tomatoes (Santos et al. 2006), these results are not applicable to cucurbits because neither metolachlor or trifloxysulfuron are registered in the US for cucurbits, and halosulfuron can have phytotoxic effects on cucurbits.

All other potential or available methyl bromide alternatives are also technically infeasible for U.S. cucurbits.

3. IS THE USE COVERED BY A CERTIFICATION STANDARD?

Methyl bromide is not used to meet a certification standard for cucurbit vegetable production.

4. IF PART OF THE CROP AREA IS TREATED WITH METHYL BROMIDE, INDICATE THE REASON WHY METHYL BROMIDE IS NOT USED IN THE OTHER AREA, AND IDENTIFY WHAT ALTERNATIVE STRATEGIES ARE USED TO CONTROL THE TARGET PATHOGENS AND WEEDS WITHOUT METHYL BROMIDE THERE.

- In Southeastern U.S. Georgia, and Maryland, areas not treated do not have nutsedges or pathogens naturally present in cucurbit fields. Simple absence of all pests is the only reason these areas are not presently treated with methyl bromide.

- In Delaware and Maryland areas without the existence of several races of *Fusarium oxysporum niveum*, one of which is highly aggressive, or without high concentration of the pathogen could use some alternatives such as 1,3-D.

5. WOULD IT BE FEASIBLE TO EXPAND THE USE OF THESE METHODS TO COVER AT LEAST PART OF THE CROP THAT HAS REQUESTED USE OF METHYL BROMIDE? WHAT CHANGES WOULD BE NECESSARY TO ENABLE THIS?

The primary reason that some cucurbits may be grown without methyl bromide in these regions is the absence of both key target pests and constraints to use of alternatives (e.g., absence of nutsedge, nematodes, and fungal pathogens in the Southeast, and Georgia, several races of *Fusarium* and nutsedges in Delaware and Maryland, and karst topographic features in Georgia).

The USG has reviewed all factors affecting transition rates in this sector. Based on this assessment the transition rate has been greatly increased for most portions of this sector. For the area covered in this nomination, the USG believes that the narrative discussion included in this document is technically valid. The USG has nominated amounts of methyl bromide based only on those sub-sectors that cannot transition away from methyl bromide at the accelerated rate.

6. SUMMARY OF RECENT RESEARCH:

Narrative description of studies relevant to key pathogens

This section focuses on research relevant to effectiveness of methyl bromide alternatives against *Fusarium* wilt, since that is the main key pest cited by CUE applicants from the Maryland/Delaware regions. In studies with vegetable crops in the southeastern US, 1, 3 D + chloropicrin has generally shown better control of fungi than metam-sodium formulations (though still not as good as control with methyl bromide). For example, in a study using a bell pepper/squash rotation in small plots, Webster et al. (2001) found significantly lower fungal populations with 1,3 D + 35 % chloropicrin (drip applied, 146 kg/ha of 1,3 D), as compared to the untreated control. However, methyl bromide (440 kg/ha, shank-injected) reduced fungal populations even more. Iodomethane had no significant suppressive effect, as compared to the untreated control. However, neither of these methyl bromide alternatives increased squash fruit weight significantly over the untreated control. Indeed, as compared to the methyl bromide standard treatment plots, squash fruit weight was 63 % lower in the 1,3 D plots, and 41 % lower in the iodomethane plots. The proportion of unmarketable squash fruit (defined only as those fruit so bad as to have to be discarded) in the 1,3 D plots was 30 % worse than that in the methyl bromide plots, though in the iodomethane plots it was equivalent to methyl bromide .

In another study conducted on tomatoes, Gilreath et al. (1994) found that metam-sodium treatments did not match methyl bromide in terms of plant vigor at the end of the season; again, *Fusarium* was one of several pests present.

In another study, by Hausbeck and Cortright (2007), cucurbit plant vigor was measured to determine fumigant/mulch performance under either LPDE or VIF plastic mulch for the control of *Fusarium oxysporum*. Of the fumigants used in the study, the methyl bromide and iodomethane treatments resulted in cantaloupe plants with the highest vigor (Table 7.1). In general, treatments under LPDE had higher plant vigor when compared with plants grown under VIF. It is noteworthy that in this study VIF tarps were prone to wind removal, which reduces their reliability under some growing conditions.

TABLE 2: EVALUATION OF FUMIGANTS AND PLASTIC MULCHES FOR MANAGING *FUSARIUM* IN CUCURBIT CROPS 2007

TREATMENT (TIME AFTER TREATMENT TO PLANTING)	RATE OF FORMULATED PRODUCT	VIGOR*	
Untreated control under LDPE (5 days)		1.0-1.3	a**
Iodomethane+chloropicrin 50:50 under LDPE (10 days)	196 kg/ha	1.0	a
Iodomethane+chloropicrin 50:50 under VIF (10 days)	196 kg/ha	3.0	c
Methyl bromide+chloropicrin 67:33 under LDPE (10 days)	280 kg/ha	1.0	a
Methyl bromide+chloropicrin 67:33 under VIF (10 days)	280 kg/ha	2.7	bc
1,3 D + chloropicrin 65:35 under LDPE (21 days)	187 liters/ha	2.3	bc
1,3 D + chloropicrin 65:35 under VIF (21 days)	187 liters/ha	4.7	d
Chloropicrin under LDPE (14 days)	187 liters/ha	2.7	c
Chloropicrin under VIF (14 days)	187 liters/ha	3.3	cd

*Vigor rating of plant health; 1=healthy plants with no stunting, 5= moderated plant stunting with variable stand, 10=complete plant death.
**Column means with a letter in common are not significantly different (Fisher LSD Method; *P*=0.05).
From Hausbeck and Cortright 2007.

In addition to the limitations of VIF discussed above, the USG notes that the plant vigor in 1,3 D treatments in these new trials is lower than that seen in methyl bromide treatments. This is similar to what was seen in previous years' tests (Hausbeck and Cortright 2004; see also discussions in earlier cucurbit nominations).

As far as the USG has been able to determine, no other studies have been conducted since 2007 to evaluate the technical and commercial feasibility of fumigant alternatives to methyl bromide for controlling *F. oxysporum* subtypes under production conditions relevant to the Maryland/Delaware regions.

Research continues to also be conducted to identify *Fusarium* resistant watermelon stock that can be grafted on a commercially feasible basis. While rootstocks protective under conditions of low to moderate pathogen infestation have been identified and tested, this work will require several more years before it produces methyl bromide alternatives that are both technically and economically feasible, and that functions under severe infestations. Such work is being planned in the southeastern US (Roberts et al. 2007, Taylor et al. 2007, Bruton, personal communication). Results of cucurbit rootstock resistant to root knot nematode (*Meloidogyne incognita*) were presented at the MBAO conference in November 2008 (Kokalis Burrell et al. 2008, Kubota et al. 2008). Results with muskmelon showed that the evaluated rootstocks have potential as an option in an integrated multi-tactic approach to replace methyl bromide. However, this work is in its initial stages and further evaluation is needed to assess feasibility of control of other soil pests. Furthermore, these trials did not evaluate resistance or commercial feasibility of rootstocks against the *Fusarium* pests that are key targets for the Maryland/Delaware region. In general, grafting of resistant rootstocks is still in an early stage of evaluation and commercial implementation for US east coast cucurbit production, and so the USG does not consider them viable alternatives to methyl bromide for the purposes of this nomination.

In conclusion, the USG continues to use the best case yield loss estimates from the previous years' nominations for the Maryland/Delaware region, since these need methyl bromide mainly for *F. oxysporum* control. To paraphrase these loss estimates: 1,3-D +chloropicrin is the likely best available alternative for areas in this region that can use (i.e. areas not close to the water table). Even with this alternative, a yield loss of about 6 % is likely (based on Hausbeck and Cortright, 2004, and discussions in the 2004-2007 cucurbit nominations). The economic impact of this loss is further examined in other sections of this document, below.

Narrative description of studies relevant to key weeds and nematodes

For nutsedge pests, which are widespread in all requesting regions, cucurbit growers do not currently have technically feasible alternatives to methyl bromide use at planting. Metam-sodium and 1,3 D + chloropicrin have shown some efficacy in small-plot trials in other vegetable crops (e.g, tomato). However, at best, metam sodium may allow at least 44 % yield loss, while 1,3 D may allow at least 29 % loss. Both often show less control than methyl bromide (in terms of population suppression) of nutsedges. These factors suggest that even this alternative will not be economically feasible even in the best-case technical scenario. It should be noted also that there is evidence that both 1,3 D and methyl isothiocyanate levels decline more rapidly, thus further compromising efficacy, in areas where these are repeatedly applied (Smelt et al., 1989; Ou et al., 1995; Gamliel et al., 2003). This is probably due to enhanced degradation of these chemicals by soil microbes (Dungan and Yates, 2003).

Other chemical alternatives to methyl bromide that have shown promise against nutsedges and nematodes (e.g., pebulate and dimethyl disulfide) are currently unregistered for cucurbits,

In one recent study, Culpepper and Langston (2004) conducted studies at 2 sites in spring 2003 and one site in the fall season of 2004. Plot sizes were 20 feet X 32 inches (4.94 m^2). Treatments were: Methyl bromide standard (67:33 formulation), untreated control, 2 formulations of Telone (1,3 D + chloropicrin) at various doses, followed by an additional application of either chloropicrin or metam-sodium, a third formulation of 1,3 D + chloropicrin ("Inline"), and iodomethane. An additional set of plots received the same fumigant treatments but also received an herbicide treatment (clomazone + halosulfuron) later in the season.

Watermelon – the only cucurbit crop addressed in these experiments – showed no significant (final) yield differences across any fumigant treatment. The same lack of difference was observed when herbicides were added. In fact, there was no difference in yield even when pesticide treatments were compared to the untreated control. However, nutsedge populations in the study appeared to be relatively low (e.g., 667 plants per plot or 135/m^2, in the untreated control, at the end of the study).

Furthermore, a number of important caveats must be mentioned when considering these results:

(1) Plots used were quite small, and it is not at all clear if the promising results will hold reliably in larger commercial fields. This is particularly worrisome given the highly variable results reported by other researchers for the same methyl bromide alternatives.

(2) The nutsedge populations in this study were dominated by yellow nutsedge (90 % of the total number). It is not clear if populations where purple nutsedge is dominant will be controlled as effectively. A number of other studies have indicated that purple nutsedge is a hardier species, and even in Culpepper and Langston's study, it appeared more resistant to the methyl bromide alternatives. For example, iodomethane gave "77 % control" of yellow nutsedge, but only "37 % control" of purple nutsedge. Control in this case was apparently defined as the reduction in nutsedge populations as compared to populations in the untreated control.

(3) This study was done only with watermelons, and it is not clear if other cucurbits will respond so favorably in terms of yield, or lack of phytotoxic response. Also, a custom-built applicator had to be used for the metam-sodium applications to eliminate worker exposure risks, according to the authors. It is not yet clear if such an applicator can be mass-produced and/or used reliably in a commercial setting.

Another recent study of methyl bromide alternatives involving key weed pests was done by Gilreath et al. 2005 (Crop Prot (24): 903-908). One of 3 trials in that study showed an average of 30 % lower bell pepper yields with nutsedge and nematodes as the key pests present. In the other 2 trials yields were not significantly different across different fumigant treatments, but nutsedge pressure was lower in those trials as compared to the third. Other important caveats to these results are - this was a small-plot study and was done in Florida. Thus it is not clear how applicable the results are to the more northern regions requesting methyl bromide for vegetable crops (e.g., Delaware, Maryland, and Virginia).

In addition to the studies described above, several other recent studies conducted in the production circumstances of the southeastern US have examined several fumigant alternatives to methyl bromide, most done in crops other than cucurbits/peppers (e.g., Santos et al. 2006, Candole et al. 2007, Santos and Gilreath 2007, Gilreath and Santos 2005, 2007). These studies either focused solely on nutsedge weeds or a combination of nutsedges, diseases, and nematodes. However, USG has examined these papers and concludes that for cucurbits, these studies do not meet all the criteria that allowed the use of earlier studies in estimating yield and quality losses that may occur if such methyl bromide alternatives are used as direct replacements for methyl bromide.

These criteria are: the use of fumigant alternatives registered for the crop nominated, the presence of both a methyl bromide standard and an untreated control as treatments as well as the monitoring of yields under each treatment. Several such studies included a methyl bromide treatment or an untreated control but not both (Santos and Gilreath 2007, Johnson and Mullinix 2007), or included both but did not monitor yield (Candole et al. 2007), or included unregistered alternatives (e.g., Gilreath and Santos 2005, 2007, Santos et al. 2006). While these studies (the majority of which were small-plot trials) indicate continued promise of methyl bromide alternatives such as 1,3-D, metam-sodium, chloropicrin, herbicides, or combinations thereof, they cannot yet be used to alter yield estimates**.**

Therefore, for this nomination, the USG concludes that, for cucurbit growers who can only use either 1,3-D + chloropicrin or metam-sodium+chloropicrin in fall-season fumigations to control nutsedge and nematode pests, the yield loss estimates used in last year's nomination continue to be applicable. These loss estimates are illustrated in Table 7.2 below, and are used as the basis of part of the economic assessment in the following section.

TABLE 3: DATA ON YIELD LOSSES WITH LIKELY METHYL BROMIDE ALTERNATIVES AND NUTSEDGE PRESENT AS A CROP PEST.

CHEMICALS	RATE (KG/HA)	AVERAGE NUTSEDGE DENSITY (#/M^2)	AVERAGE MARKETABLE YIELD (TON/HA)	% YIELD LOSS (COMPARED TO MB)
Untreated (control)	-	300 [ab]	20.1 [a]	59.1
Methyl Bromide + Pic (67-33), chisel-injected	390 kg	90 [c]	49.1 [b]	---
1,3 D + Pic (83-17), chisel-injected	327 [l]	340 [a]	34.6 [c]	29.5
Metam Sodium, Flat Fumigation	300 [l]	320 [a]	22.6 [a]	54.0
Metam Sodium, drip irrigated	300 [l]	220 [b]	32.3 [c]	34.2

Locascio et al. 1997.

Recent studies that are useful (within the context of this nomination) in assessing technical feasibility of a combination of methyl bromide alternatives include the series of trials being conducted by Culpepper et al. at the University of Georgia (e.g., Culpepper 2006, Culpepper et al. 2007a,b, Culpepper 2008). These studies indicate that a 3-way, sequential combination of several fumigant alternatives is technically feasible for spring-time fumigation of most vegetable crops. The 3-way combination consists of 1,3 D followed by chloropicrin at about 168 kg/ha, followed by metam-sodium, all under VIF or metallized (high barrier) tarps, and will henceforth be referred to as the 'UGA 3 way', as Culpepper et al. have. An example of the results obtained in spring fumigation with this combination in peppers is presented in the table below. Results have been similar for cucurbit crops (Culpepper, personal communication; also see several research reports available from the University of Georgia at www.gaweed.com).

TABLE 4: NUMBER OF PEPPER FRUIT - METHYL BROMIDE: CHLOROPICRIN VERSUS THREE WAY COMBINATION. SPRING 2006

FRUIT SIZE	METHYL BROMIDE : CHLOROPICRIN (# OF FRUIT)	UGA 3 WAY 1,3-D FB CHLOROPICRIN FB METAM NA
Jumbo	30 b	125 a
X-Large	219 a	237 a
Large	153 a	143 a
Chopper	217 a	252 a
Cull	11 a	9 a
Jumbo + X-Large + Large	402 b	505 a

Footnote: Culpepper 2006. fb means followed by or a sequential treatment. Plots were 3 rows by 100 feet long.

Since Georgia is similar to other areas of the southeastern US, except Maryland/Delaware cucurbits which face a different key pest (*F. oxysporum niveum*), these results should be applicable to **spring** usage of methyl bromide in these regions. However, other results thus far indicate that **summer**/**fall** fumigation is not similarly effective with this combination of alternatives (Culpepper, personal communication, Culpepper 2006, 2008).

Results of one of several experiments conducted by Culpepper et al. at the University of Georgia illustrate the infeasibility of the use of the 'UGA 3 way' method in place of methyl bromide for fall-season fumigations in vegetable production. In this experiment, fields were fumigated during for fall-season crop production on July 17 2007. Soil temperature was 84 degrees at 8 inches. The experiment consisted of 4 fumigant treatments (Table 7.4) that were replicated three times. Even under high-barrier film ("Blockade"), the 'UGA 3 way' gave less control of purple nutsedge as compared to the methyl bromide standard under the same type of film. Yields were consistently lower with the 'UGA 3 way' as well, with a roughly 50 % reduction in both number and weight of harvested vegetables (Table 7.4). The economic implications of this level of yield loss for Georgia cucurbit growers are further described in Part E, below.

TABLE 5: COMPARING METHYL BROMIDE AND THE 3-WAY FOR THE CONTROL OF NUTSEDGE AND PEPPER YIELD.

FUMIGANT	MULCH	LATE-SEASON PURPLE NUTSEDGE CONTROL	HARVESTS 1-2 (JUMBO PEPPER)		HARVESTS 1-4 (JUMBO PEPPER)	
		%	# fruit/plot	lbs/plot	# fruit/plot	lbs/plot
UGA-3 Way	LDPE	48 d	34 c	16 c	44 c	19 c
UGA-3 Way	Blockade	60 c	50 b	24 b	71b	32 b
Methyl Bromide + chloropicrin	Blockade	85 b	106 a	48 a	136 a	61 a
None	LDPE	0 f	13 d	6 d	19 d	8 d

Notes: (1) The UGA 3 Way consisted of 1,3 D at approximately 192 kg/ha, followed by chloropicrin at 168 kg/ha, followed by metam-sodium at approximately 358 kg/ha. Methyl bromide + chloropicrin was applied in a 50:50 mix at approximately 160 kg/ha of each. Rates as shown are not planting bed-strip adjusted. (2) "Mulch" refers to the tarp type. LDPE = traditional high permeability tarp; Blockade = low permeability tarp manufactured by Pliant Corp.

It is important to note that caveats accompany even the technical feasibility of the 'UGA 3 way' use in spring fumigations. Growers must make several application modifications to properly use the approach, and this may incur significant capital expenditure. Culpepper et al. estimate their costs to do this for their research trials at about $ 15,000 (Culpepper et al. 2007). Application costs will also increase as more chemicals and runs of tractor equipment are required to conduct the 'UGA 3 way', and the cost of VIF or metallized film is between 1.75 and two times greater than standard LBPF (Culpepper, personal communication).

Time and further research and extension education will also be needed to implement the 'UGA 3-way' method in areas outside Georgia where the method has been less-studied, and where different problems may need to be resolved. An example of this issue is illustrated in recent work by Chellemi et al. (2008). These researchers evaluated the 'UGA 3 way' in on-farm tests in Florida peppers. Results of four trails were highly variable, with two showing better yields than the methyl bromide standard, and two showing worse results. All four trials showed a reduction in larger (more profitable) peppers in the 'UGA 3 way' as compared to the methyl bromide standard. The cause appeared to be an overload of potassium in the soil, created by the combined use of the metam-potassium in the ‘UGA 3 way’ and the growers’ standard practice of applying a high-potassium fertilizer.

7. ECONOMIC FEASIBILITY OF ALTERNATIVES

The following economic analysis is organized by methyl bromide critical use application regions.

Readers please note that in this study net revenue is calculated as gross revenue minus operating costs. This is a good measure as to the direct losses of income that may be suffered by the users. It should be noted that net revenue does not represent net income to the users. Net income, which indicates profitability of an operation of an enterprise, is gross revenue minus the sum of operating and fixed costs. Net income should be smaller than the net revenue measured in this study. We did not include fixed costs because it is often difficult to measure and verify.

Summary of Economic Feasibility

The economic analysis of cucurbit applications compared data on the yields, crop prices, revenues and costs of using methyl bromide or alternative pest control regimens. This was done in order to estimate impacts on cucurbit growers with the decreasing availability of methyl bromide. The Georgia 3-Way (1,3-Dichloropicrin with Chloropicrin followed by metam sodium) was identified as being a technically feasible alternative (in cases of low pest infestation[1]) to methyl bromide in Georgia and the Southeastern United States. Due to differences in climate and pests, it is uncertain whether or not the same assumption holds for Maryland and Delaware cucurbit production. 1,3-D + chloropicrin and metam sodium are also presented in this analysis as recognized alternatives to methyl bromide; however, neither are considered technically feasible as yield losses are expected.

The economic reviewers analyzed crop budgets for pre-plant sectors to determine the likely economic impact if methyl bromide were unavailable. Various measures were used to quantify the impacts, including the following:

(1) **Loss per Hectare.** For crops, this measure is closely tied to income. It is relatively easy to measure, but may be difficult to interpret in isolation.

(2) **Loss per Kilogram of Methyl Bromide**. This measure indicates the value of methyl bromide to crop production.

(3) **Loss as a Percentage of Gross Revenue.** This measure has the advantage that gross revenues are usually easy to measure, at least over some unit, *e.g.*, a hectare of land or a storage operation. However, high value commodities or crops may provide high revenues but may also

[1] It should be noted that the USG does not request methyl bromide for use in areas of low to moderate pest pressure. Only cases where key pests are present at moderate to high levels require methyl bromide for pest pressure.

entail high costs. Losses of even a small percentage of gross revenues could have important impacts on the profitability of the activity.

(4) **Loss as a Percentage of Net Operating Revenue**. We define net cash revenues as gross revenues minus operating costs. This is a very good indicator as to the direct losses of income that may be suffered by the owners or operators of an enterprise. However, operating costs can often be difficult to measure and verify.

(5) **Operating Profit Margin**. We define operating profit margin to be net operating revenue divided by gross revenue per hectare. This measure would provide the best indication of the total impact of the loss of methyl bromide to an enterprise. Again, operating costs may be difficult to measure and fixed costs even more difficult, therefore fixed costs were not included in the analysis.

These measures represent different ways to assess the economic feasibility of methyl bromide alternatives for methyl bromide users, who are cucurbit producers in this case. Because producers (suppliers) represent an integral part of any definition of a market, we interpret the threshold of significant market disruption to be met if there is a significant impact on commodity suppliers using methyl bromide. The economic measures provide the basis for making that determination.

Maryland and Delaware

The U.S. concludes that, at present, no economically feasible alternatives to methyl bromide exist for use in Maryland and Delaware melon production. Yield loss and missed market windows, which are discussed individually below, have proven most important in reaching this conclusion.

1. Yield Loss

Expected yield losses of 6% are anticipated throughout Maryland and Delaware melon production.

2. Missed Market Windows

USG agrees with Maryland and Delaware’s assertion that growers will likely receive significantly lower prices for their produce if they switch to 1,3-D + chloropicrin. This is due to changes in the harvest schedule caused by the above described soil temperature complications and extended plant back intervals when using 1,3-D + chloropicrin.

The analysis of this effect is based on the fact that prices farmers receive for their cucurbits vary widely over the course of the growing season. Driving these fluctuations are the forces of supply and demand. Early in the growing season, when relatively few cucurbits are harvested, the supply is at its lowest and the market price is at its highest. As harvested quantities increase, the price declines. In order to maximize their revenues, cucurbit growers manage their production systems with the goal of harvesting the largest possible quantity of cucurbits when the prices are at their highs. The ability to sell produce at these higher prices makes a significant contribution toward the profitability of cucurbit operations.

To describe economic conditions in Maryland and Delaware melon production, EPA used weekly and monthly cucurbit sales and production data from the U.S. Department of Agriculture for the previous three years to gauge the impact of early season price fluctuations on gross revenues. Though data availability was limiting, analysts assumed that if cucurbit growers adjust the timing of their production system, as required when using 1,3-D + Chloropicrin, gross revenues will decline by approximately 5% over the course of the growing season, due solely to price effects. The season average price was reduced by 5% in the analysis of the alternatives to reflect this effect. Based on currently available information, the U.S. believes this reduction in price serves as a reasonable indicator of the typical effect of planting delays resulting when methyl bromide alternatives are used in Maryland and Delaware melon production.

<u>Other Considerations:</u>

In Maryland and Delaware cucurbits, *Fusarium oxypsorum niveum* exists in three separate races, and no one crop cultivar has resistance to all races. Crop experts in Maryland report that methyl bromide alternatives provided lower protection against the pathogen while also creating obstacles to meeting premium market windows. USG believes that the best alternatives (1,3 D + chloropicrin) may offer some defense against the pathogen (with a yield loss similar to that likely in Michigan). However, since the crop acreage involved is in low-lying coastal plain, water-logged soils frequently occur in rainy periods and this could delay fumigation with this and other alternatives (such as metam-sodium) and cause additional losses by forcing growers to miss key mid-July market windows.

The Southeastern USA[2] and Georgia

In the Southeastern U.S. and Georgia, using the Georgia 3-Way on spring plantings is believed to be a technically (and thus economically) feasible alternative to methyl bromide, although some limitations exist. Referring to Tables 6 through 14, the loss of gross revenue using the Georgia 3-Way is negligible for Georgia and the Southeastern U.S., while in some cases gains in gross revenue are expected in Georgia. Unlike spring plantings, however, yield losses are expected in fall plantings, with studies in Georgia's application show a 50% yield loss. The Georgia 3-Way also cannot be used on cucurbits that are grown in karst soils since it contains 1,3-D. Therefore, for fall plantings and areas with karst soils, the use of methyl bromide is critical to Georgia's and the Southeastern United States' cucurbit production. Note that data describing Georgia cucurbit production is based on double cropping production practices.

<u>Southeastern U.S. Analytical Notes</u>

The applicant provided no data on the operating costs of alternatives. Analysts assumed, however, that these costs were similar to those of methyl bromide with slight upward adjustments for the costs of applying the alternatives and a slight downward adjustment for the cost of the alternative product. In addition, the applicant did not provide data for second crops

[2] Except Georgia

(including revenues and operating costs). Analysts assumed that Southeastern cucurbits are grown in a single crop production system. However, if double cropping is practiced in the actual production system, this assumption could make the critical need for methyl bromide appear smaller than it actually is, because the value the second crop derives from methyl bromide is not included in the analysis

Georgia Analytical Notes

Other potentially significant economic factors, such as price reductions due to missed market windows, were not analyzed for this region as the case for critical use of methyl bromide is sufficiently strong based solely on Georgia 3-Way fall yield losses.

Economic analysis of Georgia growing conditions included cost and production data representing a second cucurbits or peppers crop.

TABLE 6. MARYLAND AND DELAWARE MELON - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

MARYLAND AND DELAWARE MELON	METHYL BROMIDE	1,3-D + CHLOROPICRIN
PRODUCTION LOSS (%)	0%	6%
PRODUCTION PER HECTARE	2,347	2,207
* PRICE PER UNIT (US$)	$11	$11
= GROSS REVENUE PER HECTARE (US$)	$25,822	$24,273
- OPERATING COST PER HECTARE (US$)	$21,073	$20,366
= NET REVENUE PER HECTARE (US$)	$4,749	$3,907
LOSS MEASURES *		
1. LOSS PER HECTARE (US$)	$0	$843
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$11
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	3%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	18%
5. OPERATING PROFIT MARGIN (%)	18%	16%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a “loss” should be interpreted as a “gain”. Positive numbers can be interpreted as losses.

TABLE 7. SOUTHEASTERN USA (EXCEPT GEORGIA) CUCUMBER -: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

SOUTHEAST USA (EXCEPT GEORGIA) CUCUMBER	METHYL BROMIDE	GEORGIA 3-WAY	1,3-D + CHLOROPICRIN	METAM SODIUM
PRODUCTION LOSS (%)	0%	0%	29%	44%
PRODUCTION PER HECTARE	828	828	588	464
* PRICE PER UNIT (US$)	$16	$16	$16	$16
= GROSS REVENUE PER HECTARE (US$)	$13,245	$13,245	$9,404	$7,417
- OPERATING COST PER HECTARE (US$)	$10,556	$10,652	$9,691	$9,736
= NET REVENUE PER HECTARE (US$)	$2,689	$2,593	-$288	-$2,319
LOSS MEASURES *				
1. LOSS PER HECTARE (US$)	$0	$96	$2,976	$5,007
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$1	$32	$54
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	1%	22%	38%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	4%	111%	186%
5. OPERATING PROFIT MARGIN (%)	20%	20%	-3%	-31%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a "loss" should be interpreted as a "gain". Positive numbers can be interpreted as losses.

TABLE 8. SOUTHEASTERN USA (EXCEPT GEORGIA) MELONS - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

SOUTHEAST USA (EXCEPT GEORGIA) MELON	METHYL BROMIDE	GEORGIA 3-WAY	1,3-D + CHLOROPICRIN	METAM SODIUM
PRODUCTION LOSS (%)	0%	0%	29%	44%
PRODUCTION PER HECTARE	815	815	579	457
* PRICE PER UNIT (US$)	$15	$15	$15	$15
= GROSS REVENUE PER HECTARE (US$)	$12,232	$12,232	$8,685	$6,850
- OPERATING COST PER HECTARE (US$)	$11,202	$11,297	$10,337	$10,381
= NET REVENUE PER HECTARE (US$)	$1,030	$934	($1,652)	-$3,531
LOSS MEASURES *				
1. LOSS PER HECTARE (US$)	$0	$96	$2,682	$4,562
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$1	$29	$49
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	1%	22%	37%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	9%	260%	443%
5. OPERATING PROFIT MARGIN (%)	8%	8%	-19%	-52%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a "loss" should be interpreted as a "gain". Positive numbers can be interpreted as losses.

TABLE 9. SOUTHEASTERN USA (EXCEPT GEORGIA) SQUASH -: ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

SOUTHEAST USA (EXCEPT GEORGIA) SQUASH	METHYL BROMIDE	GEORGIA 3-WAY	1,3-D + CHLOROPICRIN	METAM SODIUM
PRODUCTION LOSS (%)	0%	0%	29%	44%
PRODUCTION PER HECTARE	311	311	221	174
* PRICE PER UNIT (US$)	$29	$29	$29	$29
= GROSS REVENUE PER HECTARE (US$)	$9,029	$9,029	$6,411	$5,056
- OPERATING COST PER HECTARE (US$)	$7,338	$7,433	$6,473	$6,517
= NET REVENUE PER HECTARE (US$)	$1,692	$1,596	-$62	-$1,461
LOSS MEASURES *				
1. LOSS PER HECTARE (US$)	$0	$96	$1,754	$3,152
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$1	$19	$34
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	1%	19%	35%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	6%	104%	186%
5. OPERATING PROFIT MARGIN (%)	19%	18%	-1%	-29%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a “loss” should be interpreted as a “gain”. Positive numbers can be interpreted as losses.

TABLE 10. ALL SOUTHEASTERN US (EXCEPT GEORGIA) CUCURBITS - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

ALL SOUTHEAST US (EXCEPT GEORGIA) CUCURBITS	METHYL BROMIDE	GEORGIA 3-WAY	1,3-D + CHLOROPICRIN	METAM SODIUM
PRODUCTION LOSS (%)	0%	0%	29%	44%
PRODUCTION PER HECTARE	652	652	463	303
* PRICE PER UNIT (US$)	$18	$18	$18	$17
= GROSS REVENUE PER HECTARE (US$)	$11,502	$11,502	$8,166	$5,235
- OPERATING COST PER HECTARE (US$)	$9,802	$9,899	$8,939	$8,984
= NET REVENUE PER HECTARE (US$)	$1,700	$1,603	-$773	-$3,749
LOSS MEASURES *				
1. LOSS PER HECTARE (US$)	$0	$97	$2,472	$5,449
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$1	$27	$59
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	1%	21%	47%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	6%	145%	321%
5. OPERATING PROFIT MARGIN (%)	15%	14%	-9%	-72%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a “loss” should be interpreted as a “gain”. Positive numbers can be interpreted as losses.

TABLE 11. GEORGIA CUCUMBER - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

GEORGIA CUCUMBERS	METHYL BROMIDE	GEORGIA 3-WAY: SPRING APPLICATION	GEORGIA 3-WAY: FALL APPLICATION
PRODUCTION LOSS (%)	0%	0%	50%
PRODUCTION PER HECTARE	5,740	5,740	2,870
* PRICE PER UNIT (US$)	$12	$12	$12
= GROSS REVENUE PER HECTARE (US$)	$67,223	$67,223	$33,611
- OPERATING COST PER HECTARE (US$)	$54,251	$40,226	$40,226
= NET REVENUE PER HECTARE (US$)	$12,972	$26,997	-$6,615
LOSS MEASURES *			
1. LOSS PER HECTARE (US$)	$0	-$14,024	$19,587
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	-$151	$211
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	-21%	29%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	-108%	151%
5. OPERATING PROFIT MARGIN (%)	19%	40%	-20%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a “loss” should be interpreted as a “gain”. Positive numbers can be interpreted as losses.

TABLE 12. GEORGIA MELON ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

GEORGIA MELONS	METHYL BROMIDE	GEORGIA 3-WAY: SPRING APPLICATION	GEORGIA 3-WAY: FALL APPLICATION
PRODUCTION LOSS (%)	0%	0%	50%
PRODUCTION PER HECTARE	4,275	4,275	2,137
* PRICE PER UNIT (US$)	$12	$12	$12
= GROSS REVENUE PER HECTARE (US$)	$49,696	$49,696	$24,848
- OPERATING COST PER HECTARE (US$)	$42,085	$43,288	$43,288
= NET REVENUE PER HECTARE (US$)	$7,610	$6,408	-$18,440
LOSS MEASURES *			
1. LOSS PER HECTARE (US$)	$0	$1,202	$26,050
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	$13	$280
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	2%	52%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	16%	342%
5. OPERATING PROFIT MARGIN (%)	15%	13%	-74%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a “loss” should be interpreted as a “gain”. Positive numbers can be interpreted as losses.

TABLE 13. GEORGIA SQUASH - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

GEORGIA SQUASH	METHYL BROMIDE	GEORGIA 3-WAY: SPRING APPLICATION	GEORGIA 3-WAY: FALL APPLICATION
PRODUCTION LOSS (%)	0%	0%	50%
PRODUCTION PER HECTARE	5,251	5,251	2,625
* PRICE PER UNIT (US$)	$8	$8	$8
= GROSS REVENUE PER HECTARE (US$)	$40,556	$40,538	$20,269
- OPERATING COST PER HECTARE (US$)	$43,739	$31,348	$31,348
= NET REVENUE PER HECTARE (US$)	-$3.183	$9,188	-$11,079
LOSS MEASURES *			
1. LOSS PER HECTARE (US$)	$0	-$12,372	$7,896
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	-$132	$85
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	-31%	19%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	-389%	248%
5. OPERATING PROFIT MARGIN (%)	-6%	21%	-58%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a “loss” should be interpreted as a “gain”. Positive numbers can be interpreted as losses.

TABLE 14. ALL GEORGIA CUCURBITS - ECONOMIC IMPACTS OF METHYL BROMIDE ALTERNATIVES

GEORGIA CUCURBITS	METHYL BROMIDE	GEORGIA 3-WAY: SPRING APPLICATION	GEORGIA 3-WAY: FALL APPLICATION	1,3-D + CHLOROPICRIN
PRODUCTION LOSS (%)	0%	0%	50%	29%
PRODUCTION PER HECTARE	4,741	4,741	2,370	3,404
* PRICE PER UNIT (US$)	$10	$10	$10	$10
= GROSS REVENUE PER HECTARE (US$)	$46,439	$46,435	$23,217	$33,325
- OPERATING COST PER HECTARE (US$)	$44,278	$40,213	$40,213	$43,999
= NET REVENUE PER HECTARE (US$)	$2,161	$6,222	-$16,995	-$10,675
LOSS MEASURES *				
1. LOSS PER HECTARE (US$)	$0	-$4,062	$19,156	$12,835
2. LOSS PER KILOGRAM OF METHYL BROMIDE (US$)	$0	-$44	$206	$138
3. LOSS AS A PERCENTAGE OF GROSS REVENUE (%)	0%	-9%	41%	28%
4. LOSS AS A PERCENTAGE OF NET OPERATING REVENUE (%)	0%	-188%	887%	594%
5. OPERATING PROFIT MARGIN (%)	5%	13%	-73%	-32%

* Interpret the loss measures with caution. Negative numbers presented in rows indicating a "loss" should be interpreted as a "gain". Positive numbers can be interpreted as losses.

8. RESULTANT CHANGES TO REQUESTED EXEMPTION QUANTITIES

The USG has applied an aggressive transition rate, which is reflected in the nomination amount and detailed in Table 15.

TABLE 15. NOMINATION AMOUNT.

SECTOR		CUCURBITS					
		Mardel Cucurbit	Southeast Cucurbit	Georgia - Squash	Georgia - Cucumber	Georgia - Melon	Sector Total / Average
Quantity Requested for 2012:	Amount (kgs)	1,739	38,321	4,076	3,285	12,073	59,496
Quantity Recommended by MBTOC/TEAP for 2012 :	Amount (kgs)	1,739	38,321	4,076	3,285	12,073	59,494
Quantity Approved by Parties for 2012:	Amount (kgs)	1,739	38,321	4,076	3,285	12,073	59,494
	Area (ha)	33	853	88	68	264	1,306
	Rate	52	45	46	48	46	46
Transition from 2012 Baseline Adjusted Value	Percentage (%)	-80%	-80%	-80%	-80%	-80%	-80%
Quantity Required for 2013 Nomination:	Amount (kgs)	348	7,664	815	657	2,415	11,899
	Area (ha)	2	51	5	4	16	79
	Rate	150	150	150	150	150	150

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